The Implications of High Numbers of Fecal Indicator Organisms in Sub-Tropical Beach Sands

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The quality of beaches in the U.S. are routinely tested by counting the numbers of fecal indicator organisms (e.g. *E. coli,* enterococci) in the water. When the numbers are high, the beach is closed as a health precaution. However, there are clues in the literature that suggest that the microbiological quality of beach sand (not water) may constitute a health risk to bathers, particularly children, who play in wet sand. This is because sand is an effective filter that might trap and concentrate bacteria from the water. Moreover, since the crevices of sand particles offer a protected microhabitat rich in nutrients, bacteria at these protected sites may show enhanced survival.

In a study supported by the EPA, the number of traditional and novel indicator organisms (i.e., fecal bacteria and a range of other microorganisms of possible concern) were compared in bathing water, wet sand and dry sand at beaches in south Florida. Coincident with these studies, the survival of indicator organisms in sand versus seawater was compared in laboratory experiments. Possible increased health risk to individuals (particularly children) exposed to sand rich in indicator organisms was examined using a beach questionnaire. Scientists and graduate students from Nova Southeastern University and Florida Atlantic University conducted this work.

Results showed that sand concentrated bacteria some 50 to 100 fold relative to water. Two important questions arise from this finding. Firstly, do these counts mirror the presence of pathogens in the water or are the counts misleading and due to the survival of 'environmentally adapted' indicator bacteria? Or secondly, does sand act as a sink for indicator organisms that could be flushed out on tidal cycles? The latter scenario has consequences for water managers involved in the routine testing of beaches via water samples. The impacts of this study can be summarized as follows:

- A beach questionnaire on health issues after beach visits gave no clear evidence of increased respiratory or enteric symptoms in beach users.
- Fecal indicator counts in the 'swash zone' were sometimes 10 times higher than in water 4 m offshore—water managers should sample well out of this zone when testing beaches.
- The presence of some beach microbes, never before considered, should be examined in future research. For example, Acanthamoeba (a microbe occasionally responsible for the serious eye infection amoebic keratitis), was found in 50 % of all sand samples processed.